U. S. FOREST SERVICE

RESEARCH NOTE LS-10

LAKE STATES FOREST EXPERIMENT STATION · U. S. DEPARTMENT OF AGRICULTURE

Current Status of the Sapstreak Disease of Sugar Maple in the Lake States

The first report of sapstreak in the Lake States was made by Kessler and Anderson in 1960 when they found a single sugar maple (*Acer saccharum* Marsh.) on the Upper Peninsula Experimental Forest in the later stages of the disease and isolated the causal fungus *Ceratocystis coerulescens* (Münch) Bakshi from it.[1] Hepting had described the disease and determined its cause in 1944.[2] At that time its known range was limited to a relatively small area in North Carolina. In 1959, Roth et al. found occasional yellow-poplars (*Liriodendron tulipifera* L.) infected by the same fungus and displaying similar symptoms in scattered locations in Tennessee and North Carolina.[3] They also stated that the original infection center of sugar maple in North Carolina had shown little tendency to spread beyond the relatively restricted area first reported.

After the first discovery of the disease in the Lake States, small-scale studies of incidence were made in northern Wisconsin and the Upper Peninsula of Michigan during 1961, but no additional infected trees were found.

In June and July of 1962, however, five infected trees were detected on the basis of their rather distinctive crown symptoms. Leaves were about one-half normal size and slightly chlorotic; some had far fewer leaves than normal (fig. 1). In addition, three of the trees bore a much heavier crop of seed

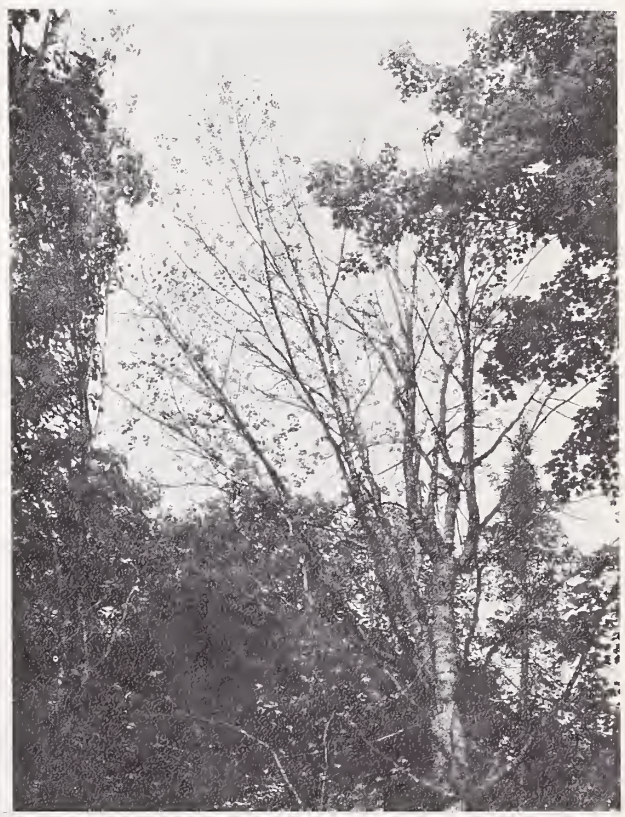

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FIGURE 1. — Crown symptoms of sugar maple in the later stages of the sapstreak disease. Note the abnormally small, sparse leaves.

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1 *Kessler, K. J., Jr., and Anderson, R. L. Ceratocystis coeruleseens on sugar maple in the Lake States. Plant Dis. Rptr. 44: 348-350. 1960.*

2 *Hepting, George H. Sapstreak, a new killing disease of sugar maple. Phytopath. 34: 1069-1076. 1944.*

3 *Roth, Elmer; Hepting, George H.; and Toole, E. Richard. Sapstreak disease of sugar maple and yellow poplar in North Carolina. Phytopath. 49: 549. Abs. 1959.*

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FIGURE 2. — Characteristic stain pattern in cross section. *Left*: at stump height. *Right*: at 17 feet. Note the many narrow points extending toward the cambium. On freshly cut surfaces the apices of these points are green. Reddish to grey radial streaking is present within the main body of tan to brown discoloration. The circular, darker stain in the center is dark heart.

than nearby healthy trees. Four of the five were on the Upper Peninsula Experimental Forest located near Dukes, Mich., in the central part of the Peninsula. They were not in close proximity to the original infected tree. The fifth was approximately 20 miles west of the Experimental Forest.

These trees were cut immediately and checked for the characteristic stain pattern found within the bole of infected trees (fig. 2). All had similar patterns. Cultures of wood chips from stained areas all yielded the causal fungus. In addition, five dead but still standing sugar maples, found in the same general area, were checked for evidence of the disease. Cultures of *C. coerulescens* could not be obtained from any of these, but one faintly exhibited the stain pattern. The other four were badly decayed by saprophytic organisms. No other reason (suppression, overmaturity, etc.) could account for their death, and it seems probable that sapstreak was responsible.

As part of a long-term forest management study, the stand from which three diseased and three probably diseased sugar maples had

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FIGURE 3. — Stain pattern on sugar maple with incipient sapstreak infection. Five separate infections were traced from covered root wounds on this tree. The circular, darker stain in the center is dark heart.

been cut was scheduled for a selective cutting the following November. At that time, 147 felled trees were examined for sapstreak. Seven positive cases were found plus two probable cases; both of the latter were dead trees. Thus, total incidence of the disease in the trees examined in this stand was at least 6.5 percent (10 of 153) and probably 9.8 percent (15 of 153).

All of the trees examined during logging were incipient cases. The stain pattern had not progressed as far as in previous infected trees examined, and thus could be more readily traced to its likely point of entry. Figure 3 shows the pattern on a stump in which the stain appeared to have originated from at least five separate wounds on main roots. Two of these wounds and their associated stains are shown in figures 4 and 5. Six of the seven trees had wounds and associated stains of this type. That is, the wounds were old, some had considerable callus around their margins, and all were covered either by adhering dead bark or by litter and duff. The seventh infected tree differed considerably from the others examined to date: The stain was heaviest in the top, decreased toward the base, and was not visible on the stump. Its point of origin appeared to be the healed-over branch stub shown in figure 6.

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FIGURE 4. — Stain originating from a root wound on the same stump as in figure 3. The wound is the dark area at arrow. Note the band of stain on the stump face immediately above the wound.

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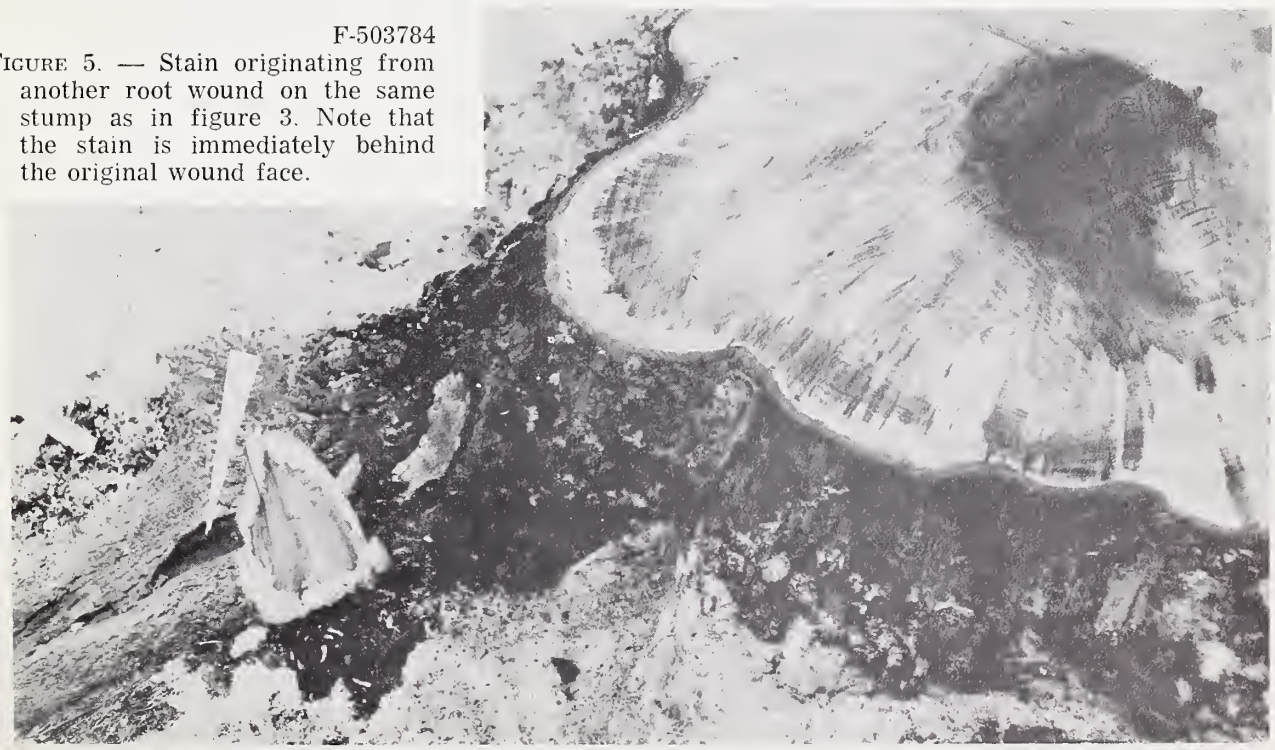
FIGURE 5. — Stain originating from another root wound on the same stump as in figure 3. Note that the stain is immediately behind the original wound face.



In October 1962 a large-scale, more intensive study of sapstreak incidence was begun. The technique being used is based primarily on the characteristic stain pattern found on the stumps of infected trees. This pattern is such that experienced personnel can rather easily distinguish it from other stains such as dark heart, mineral stain, and the stains associated with various heartrots commonly seen in sugar maple. Active or recently completed logging jobs throughout the Upper Peninsula of Michigan and northern Wisconsin are being visited, suitable stumps examined (those which have not deteriorated to the point where the stain cannot be identified with certainty), and cultures made from suspect stumps. By December 15, 1962, 23 logging operations in the Upper Peninsula had been visited and 2,193 stumps examined. Of these, only one tree located in Baraga County approximately 60 miles northwest of the Experimental Forest was infected with sapstreak. The survey is still continuing, and the results will be published when completed.

In all, 14 positive cases and 7 probable cases of sapstreak in sugar maple have been found since 1960. All infected trees were of dominant or codominant crown class and ranged in diameter from 10.6 inches to 23.0 inches d.b.h. The associated stain was present from roots to varying heights in the bole (the highest being 57 feet or well into the top branches) except in the one case already mentioned where it appeared to have entered from the top at 43 feet and extended downward to about 9 feet. In all infected trees examined, the stain was so extensive that even had they been salvaged prior to mortality much of the lumber recovered would have been of little value.

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FIGURE 6 — Surface and interior views of a swollen knot. The sapstreak discoloration is the stain extending above and below the decayed branch stub. The narrow dark stain surrounding the stub is caused by the decay.

The reason for the wide discrepancy in incidence of the disease between the Upper Peninsula Experimental Forest and other areas examined to date is not known. It is fairly certain, however, that its absence in other areas is not due to the absence of the pathogen; the fungus, a common cause of sapwood stain in hardwood lumber and logs, is widely distributed throughout the Upper Peninsula. During the present survey, the authors have isolated and identified it several times in many locations where it was growing on the cut surfaces of logs and stumps, especially those cut in midsummer. Roth et al. reported that cultures obtained from sapwood stains were as pathogenic as cultures obtained from diseased trees.[4] Therefore, the high incidence on the Experimental Forest is probably related in some way to environmental conditions.

One strong possibility is that logging injuries to residual trees in stands managed under the selection system provide entry courts for the fungus. Such entry courts would not be available in undisturbed or clear-cut stands. All of the stands where sapstreak infections were found on the Experimental Forest have been partially cut at least once and some three times. Therefore, the number of wounds due to logging is probably far higher than in other areas examined.

Investigations of incidence, mode of infection, rate of spread, and methods of control of the disease are planned or in progress.

[4] *See footnote 3.*

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April 1963